Basic Router Configuration

This chapter provides procedures for configuring the basic parameters of your Cisco router, including global parameter settings, routing protocols, interfaces, and command-line access. It also describes the default configuration on startup, and contains the following sections:

- Interface Ports, page 3-2
- Default Configuration, page 3-3
- Information Needed for Configuration, page 3-4
- Configuring Command-Line Access, page 3-5
- Configuring Global Parameters, page 3-7
- Configuring WAN Interfaces, page 3-8
- Configuring the Fast Ethernet LAN Interfaces, page 3-55
- Configuring the Wireless LAN Interface, page 3-55
- Configuring a Loopback Interface, page 3-55
- Configuring Static Routes, page 3-57
- Configuring Dynamic Routes, page 3-58

Note Individual router models may not support every feature described in this guide. Features that are not supported by a particular router are indicated whenever possible.

This chapter includes configuration examples and verification steps, as available.

For complete information on how to access global configuration mode see Entering Global Configuration Mode, page A-5.

Interface Ports

Table 3-1 lists the interfaces that are supported for each router and their associated port labels on the equipment.

Table 3-1 Supported Interfaces and Associated Port Labels by Cisco Router

Router	Interface	Port Label
LAN Ports		
Cisco 860, Cisco 880, and Cisco 890 series	Fast Ethernet LAN	LAN, FE0–FE3
	Wireless LAN	(no label)
Cisco 866VAE, 867VAE	Ethernet LAN	LAN, FE0-FE3
Cisco 866VAE-K9, 867VAE-K9	Ethernet LAN	LAN, GE0, FE0-FE3
WAN Ports		
Cisco 861, 861W, 881, 881W, 881G, 881GW, 881-V	Fast Ethernet WAN	WAN, FE4
Cisco 867, 867W	ADSL2oPOTS WAN	ADSLoPOTS
Cisco 886, 886W, 886G, 886GW	ADSL2oISDN WAN	ADSLoPOTS
Cisco 887, 887W	ADSL2oPOTS WAN	ADSLoPOTS
Cisco 887V, Cisco887VW, 887VG, 887VGW	VDSL2oPOTS WAN	VDSLoPOTS
Cisco 867VA, 887VA, 887VA-M, 887VA-V, 887VA-V-W	VDSL/ADSLoPOTS WAN	VDSL/ADSLoPOTS
Cisco 888, 888W	G.SHDSL WAN	G.SHDSL
Cisco 891, 892	Fast Ethernet WAN	FE8
	Gigabit Ethernet WAN	WAN GE 0
Cisco 866VAE, 867VAE	Gigabit Ethernet WAN	WAN GE0
Cisco 866VAE-K9, 867VAE-K9	Gigabit Ethernet WAN	WAN GE1
Cisco 866VAE, 866VAE-K9	VDSL/ADSLoISDN WAN	VDSL/ADSL OVER ISDN
Cisco 867VAE, 867VAE-K9	VDSL/ADSLoPOTS WAN	VDSL/ADSL OVER POTS

Default Configuration

When you first boot up your Cisco router, some basic configuration has already been performed. All of the LAN and WAN interfaces have been created, console and vty ports are configured, and the inside interface for Network Address Translation (NAT) has been assigned. Use the **show running-config** command to view the initial configuration, as shown in the following example, for a Cisco 881W.

```
Router# show running-config


User Access Verification

Password:
Router> en
Password:
Router# show running-config
Building configuration...

Current configuration : 986 bytes
!
version 12.4
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router
!
boot-start-marker
boot-end-marker
!
enable secret 5 $1$g4y5$NxDeM.0hON6YA51bcfGvN1
enable password ciscocisco
!
no aaa new-model
!
!
!
!
no ip routing
no ip cef
!
!
!
!
!
multilink bundle-name authe
!
!
archive
 log config
  hidekeys
!
!
!
!
!
interface FastEthernet0
!
interface FastEthernet1
 shutdown
!
```

```
interface FastEthernet2
 shutdown
!
interface FastEthernet3
 shutdown
!
interface FastEthernet4
 ip address 10.1.1.1 255.255.255.0
 no ip route-cache
 duplex auto
 speed auto
!
interface Vlan1
 no ip address
 no ip route-cache
 shutdown
!
interface wlan-ap0
 description Service Module interface to manage the embedded AP
 ip unnumbered Vlan1
 no cdp enable
 arp timeout 0
!
ip route 0.0.0.0 0.0.0.0 10.1.1.1
!
!
no ip http server
no ip http secure-server
!
!
!
!
!
control-plane
!
!
line con 0
 no modem enable
line aux 0
line vty 0 4
 password cisco
 login
 transport input telnet ssh
!
scheduler max-task-time 5000

!
webvpn cef
end

Router#
```

Information Needed for Configuration

Gather the following information, depending on your planned network scenario, before configuring your network:

- If you are setting up an Internet connection, gather the following information:
  - PPP client name that is assigned as your login name

  - PPP authentication type: Challenge Handshake Authentication Protocol (CHAP) or Password Authentication Protocol (PAP)
  - PPP password to access your ISP account
  - DNS server IP address and default gateways
- If you are setting up a connection to a corporate network, you and the network administrator must generate and share the following information for the WAN interfaces of the routers:
  - PPP authentication type: CHAP or PAP
  - PPP client name to access the router
  - PPP password to access the router
- If you are setting up IP routing:
  - Generate the addressing scheme for your IP network.
  - Determine the IP routing parameter information, including IP address and ATM permanent virtual circuits (PVCs). These PVC parameters are typically virtual path identifier (VPI), virtual circuit identifier (VCI), and traffic-shaping parameters.
  - Determine the number of PVCs that your service provider has given you, along with their VPIs and VCIs.
  - For each PVC, determine the type of AAL5 encapsulation supported. It can be one of the following:

    AAL5SNAP—This can be either routed RFC 1483 or bridged RFC 1483. For routed RFC 1483, the service provider must provide you with a static IP address. For bridged RFC 1483, you may use DHCP to obtain your IP address, or you may obtain a static IP address from your service provider.

    AAL5MUX PPP—With this type of encapsulation, you need to determine the PPP-related configuration items.
- If you plan to connect over an ADSL or G.SHDSL line:
  - Order the appropriate line from your public telephone service provider.

    For ADSL lines—Ensure that the ADSL signaling type is DMT (also known as ANSI T1.413) or DMT Issue 2.

    For G.SHDSL lines—Verify that the G.SHDSL line conforms to the ITU G.991.2 standard and supports Annex A (North America) or Annex B (Europe).

After collecting the appropriate information, perform a full configuration on your router beginning with the tasks in "Configuring Command-Line Access" section on page 3-5.

If you plan to:

- Connect voice equipment, see *Cisco IOS Voice Port Configuration Guide*.
- Obtain or change software licenses, see *Software Activation on Cisco Integrated Services Routers and Cisco Integrated Service Routers G2*.

Configuring Command-Line Access

To configure parameters to control access to the router, perform the following steps, beginning in global configuration mode:

SUMMARY STEPS

1. **line** [**aux** | **console** | **tty** | **vty**] *line-number*
2. **password** *password*
3. **login**
4. **exec-timeout** *minutes* [*seconds*]
5. **line** [**aux** | **console** | **tty** | **vty**] *line-number*
6. **password** *password*
7. **login**
8. **end**

DETAILED STEPS

	Command	Purpose

Step 1	**line** [**aux**	**console**	**tty**	**vty**] *line-number*
				
				Example:
				`Router(config)# line console 0`
				`Router(config-line)#`
					Enters line configuration mode and specifies the type of line.
					
					This example specifies a console terminal for access.

Step 2	**password** *password*
	
	Example:
	`Router(config)# password 5dr4Hepw3`
	`Router(config-line)#`
		Specifies a unique password for the console terminal line.

Step 3	**login** **Example:** `Router(config-line)# login`	Enables password checking at terminal session login.
Step 4	**exec-timeout** *minutes* [*seconds*] **Example:** `Router(config-line)# exec-timeout 5 30`	Sets the time interval that the EXEC command interpreter waits until user input is detected. The default is 10 minutes. Optionally, add seconds to the interval value. This example shows a timeout of 5 minutes and 30 seconds. Entering a timeout of 0 0 specifies never to time out.
Step 5	**line** [**aux**	**console**	**tty**	**vty**] *line-number* **Example:** `Router(config-line)# line vty 0 4`	Specifies a virtual terminal for remote console access.
Step 6	**password** *password* **Example:** `Router(config-line)# password aldf2ad1`	Specifies a unique password for the virtual terminal line.

	Command	Purpose
Step 7	**login** **Example:** `Router(config-line)# login`	Enables password checking at the virtual terminal session login.

Step 8	**end**
	
	Example:
	`Router(config-line)# end`
	`Router#`
		Exits line configuration mode, and returns to privileged EXEC mode.

Example

The following configuration shows the command-line access commands.

You do not need to input the commands marked "default." These commands appear automatically in the configuration file generated when you use the **show running-config** command.

```
!
line con 0
exec-timeout 10 0
password 4youreyesonly
login
transport input none (default)
stopbits 1 (default)
line vty 0 4
password secret
login
!
```

Configuring Global Parameters

To configure selected global parameters for your router, perform these steps:

SUMMARY STEPS

1. **configure terminal**
2. **hostname** *name*
3. **enable secret** *password*
4. **no ip domain-lookup**

DETAILED STEPS

	Command	Purpose

Step 1	**configure terminal**
	
	Example:
	`Router# configure terminal`
		Enters global configuration mode when using the console port.
		
		If you are connecting to the router using a remote terminal, use the following:
		
		`telnet router name or address`
		`Login: login id`
		`Password: *********`
		`Router> enable`

Step 2	**hostname** *name* **Example:** `Router(config)# hostname Router`	Specifies the name for the router.
Step 3	**enable secret** *password* **Example:** `Router(config)# enable secret cr1ny5ho`	Specifies an encrypted password to prevent unauthorized access to the router.
Step 4	**no ip domain-lookup** **Example:** `Router(config)# no ip domain-lookup`	Disables the router from translating unfamiliar words (typos) into IP addresses.

Configuring WAN Interfaces

Configure the WAN interface for your router using one of the following as appropriate:

- Configuring a Fast Ethernet WAN Interface, page 3-9
- Configuring the Media Type, page 3-10
- Configuring a Gigabit Ethernet WAN Interface, page 3-10
- Configuring a V.92 Modem Interface, page 3-11
- Configuring a VDSL2 WAN Interface, page 3-12
- Configuring ADSL or VDSL on Cisco 860VAE and 880VA Multimode ISRs, page 3-14
- Configuring Seamless Rate Adaption, page 3-16
- Configuring UBR+, page 3-16
- Configuring ADSL Mode, page 3-17
- Configuring VDSL Mode, page 3-24
- Configuring the Training Log Using the CLI, page 3-34
- Configuring a G.SHDSL WAN Interface in ATM mode, page 3-36
- Configuring a G.SHDSL WAN Interface in EFM mode, page 3-40
- Configuring the Cellular Wireless WAN Interface, page 3-40
- Configuring WAN Mode on Cisco 860VAE ISRs, page 3-52

Configuring a Fast Ethernet WAN Interface

To configure the Fast Ethernet interface on a Cisco 861 or 881 ISR, perform these steps, beginning in global configuration mode:

SUMMARY STEPS

1. **interface** *type number*
2. **ip address** *ip-address mask*
3. **no shutdown**
4. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	**interface** *type number* **Example:** `Router(config)# interface fastethernet 4`	Enters the configuration mode for a Fast Ethernet WAN interface on the router.
Step 2	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 192.168.12.2 255.255.255.0`	Sets the IP address and subnet mask for the specified Fast Ethernet interface.
Step 3	**no shutdown** **Example:** `Router(config-if)# no shutdown`	Enables the Ethernet interface, changing its state from administratively down to administratively up.

Step 4	**exit**
	
	Example:
	`Router(config-if)# exit`
	`Router(config)#`
		Exits configuration mode for the Fast Ethernet interface and returns to global configuration mode.

Note Cisco IOS Release 15.1 (3) T introduces the **batch** command under the interface mode. You may notice a reduced CPU utilization when interface batching is enabled because packets are processed in batches resulting in more efficient cache usage.

Configuring the Media Type

Before configuring the Gigabit Ethernet interface on the Cisco 892F ISRs, you must first select the media type as either SFP or RJ45.

To configure the media type, perform the following steps, begining in global configuration mode:

SUMMARY STEPS

1. **interface** *type number*
2. **media-type** {**sfp** | **rj45**}
3. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet 0`	Enters the configuration mode for a Gigabit Ethernet WAN interface on the router.

Step 2	**media-type** {**sfp**	**rj45**}
		
		Example:
		`Router(config-if)# media-type sfp`
		`OR`
		`Router(config-if)# media-type rj45`
			Specifies an SFP physical connection.
			OR
			Specifies an RJ-45 physical connection.

Step 3	**exit**
	
	Example:
	`Router(config-if)# exit`
	`Router(config)#`
		Exits configuration mode for the Gigabit Ethernet interface and returns to global configuration mode.

Configuring a Gigabit Ethernet WAN Interface

To configure the Gigabit Ethernet (GE) WAN interface on a Cisco 891, 892, or 860VAE ISR, perform these steps, beginning in global configuration mode:

SUMMARY STEPS

1. **interface** *type number*
2. **ip address** *ip-address mask*
3. **no shutdown**
4. **exit**

DETAILED STEPS

	Command	Purpose

Step 1	**interface** *type number*
	
	Example:
	`Router(config)# interface gigabitethernet 1`
	`Router(config-if)#`
		Enters the configuration mode for a Gigabit Ethernet WAN interface on the router.

Step 2	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 192.168.12.2 255.255.255.0`	Sets the IP address and subnet mask for the specified Gigabit Ethernet interface.
Step 3	**no shutdown** **Example:** `Router(config-if)# no shutdown`	Enables the Ethernet interface, changing its state from administratively down to administratively up.

Step 4	**exit**
	
	Example:
	`Router(config-if)# exit`
	`Router(config)#`
		Exits configuration mode for the Gigabit Ethernet interface and returns to global configuration mode.

Configuring a V.92 Modem Interface

The Cisco 891 ISR has a V.92 modem backup interface. To configure this interface, perform these steps, beginning in global configuration mode:

SUMMARY STEPS

1. **interface** *type number*
2. **ip address** *ip-address mask*
3. **encapsulation** *ppp*
4. **dialer in-band**
5. **dialer string** *dial-string*
6. **dialer-group** *group-number*
7. **async mode dedicated**
8. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	**interface** *type number* **Example:** `Router(config)# interface async 1`	Enters the configuration mode for a V.92 WAN interface (serial interface) on the router.
Step 2	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 192.168.12.2 255.255.255.0`	Sets the IP address and subnet mask for the specified V.92 interface.
Step 3	**encapsulation** *ppp* **Example:** `Router(config-if)# encapsulation ppp`	Sets the encapsulation method to point-to-point protocol (PPP) for the serial interface.
Step 4	**dialer in-band** **Example:** `Router(config-if)# dialer in-band`	Specifies that dial-on-demand routing (DDR) is supported.
Step 5	**dialer string** *dial-string* **Example:** `Router(config-if)# dialer string 102`	Specifies the string (telephone number) to be used when placing a call from the interface.
Step 6	**dialer-group** *group-number* **Example:** `Router(config-if)# dialer-group 1`	Configures the interface to belong to a specific dialing access group.
Step 7	**async mode dedicated** **Example:** `Router(config-if)# async mode dedicated`	Places the line into dedicated asynchronous mode using Serial Line Internet Protocol (SLIP) or PPP encapsulation.

Step 8	**exit**
	
	Example:
	`Router(config-if)# exit`
	`Router(config)#`
		Exits configuration mode for the V.92 interface and returns to global configuration mode.

Configuring a VDSL2 WAN Interface

The VDSL2 WAN interface is used on the Cisco 887V ISR platforms. Note that the VDSL2 WAN interface uses Ethernet as the Layer 2 transport mechanism.

To configure VDSL2 on the Cisco 887V ISR, perform these steps, beginning in global configuration mode:

SUMMARY STEPS

1. **controller** *vdsl 0*
2. **interface** *type number*
3. **ip address** *ip-address mask*
4. **shutdown**
5. **no shutdown**
6. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	**controller** *vdsl 0* **Example:** `Router(config)# controller vdsl 0`	Enters controller configuration mode and the controller number. **Note** There is no need to configure any VDSL2 parameters from CPE side. Any specific VDSL2 settings should be set on the DSLAM side.
Step 2	**interface** *type number* **Example:** `Router(config)# interface ethernet 0`	Enters the configuration mode for Ethernet Layer 2 transport on the VDSL WAN interface on the router.
Step 3	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 192.168.12.2 255.255.255.0`	Sets the IP address and subnet mask for the interface.
Step 4	**shutdown** **Example:** `Router(config-if)# no shutdown`	Disables the interface, changing its state from administratively up to administratively down.
Step 5	**no shutdown** **Example:** `Router(config-if)# no shutdown`	Enables the interface, changing its state from administratively down to administratively up.
Step 6	**exit** **Example:** `Router(config-if)# exit`	Exits configuration mode and returns to global configuration mode.

Configuring ADSL or VDSL on Cisco 860VAE and 880VA Multimode ISRs

This section covers the following topics:

- Overview of Cisco 860VAE, 886VA, and 887VA Multimode ISRs, page 3-14
- ADSL2/2+ Annex M Mode on Over POTS VDSL2/ADSL Multimode Annex A SKUs, page 3-15
- Enabling ADSL2/2+ Annex M Mode on Over POTS VDSL2/ADSL Multimode Annex A SKUs, page 3-30

Overview of Cisco 860VAE, 886VA, and 887VA Multimode ISRs

The Cisco customer premise equipment (CPE) Cisco 866VAE, 867VAE, 866VAE-K9, 867VAE-K9, 886VA and 887VA integrated services routers (ISRs) support asymmetric digital subscriber line (ADSL) 1/2/2+ and very high speed digital subscriber line 2 (VDSL2) transmission modes, also called multimode.

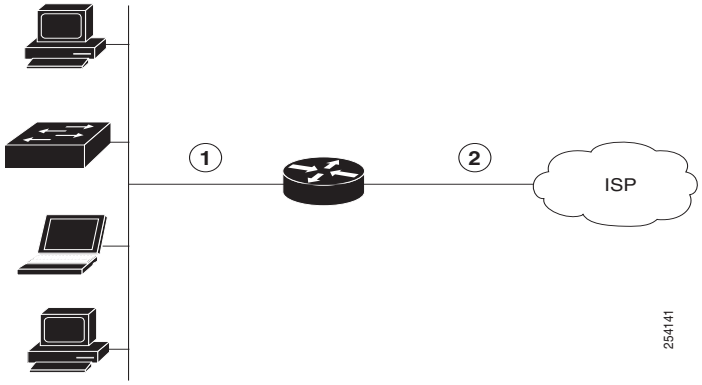
Note The 866VAE and 886VA support xDSL over ISDN. The 867VAE and 887VA support xDSL over a plain old telephone system (POTS).

The default CPE operating mode is auto. Auto mode means that the CPE trains up to the mode configured on the digital subscriber line access multiplexer (DSLAM), ADSL1/2/2+, or VDSL2.

The following examples assume the DSLAM is configured in either ADSL2+ mode or VDSL2 mode, and the CPE is configured in auto mode.

Figure 3-1 shows an ATM WAN or Ethernet WAN network topography.

Figure 3-1 Example Topology



1	Fast Ethernet LAN interface or Gigabit Ethernet LAN interface	**2**	ATM WAN interface—ADSL 1/2/2+ mode or Ethernet WAN Interface—VDSL2 mode

Note A DSLAM in Layer 1 mode may be configured for auto mode. A DSLAM in Layer 2 mode must be configured for ATM mode or packet transfer mode (PTM).

Note Cisco 886VA and 887VA allow a maximum of four permanent virtual circuits (PVCs).

Note Cisco 866VAE, Cisco 867VAE, Cisco 866VAE-K9, and Cisco 867VAE-K9 ISRs allow a maximum of two PVCs.

ADSL2/2+ Annex M Mode on Over POTS VDSL2/ADSL Multimode Annex A SKUs

Annex M is an enhancement of the G.992.3 standard that doubles the upstream bandwidth by "borrowing" 32 additional tones from the downstream frequency range. This feature enables service providers to provision symmetric data rates for ADSL2 and ADSL2+ services with data rates up to 2 Mbps.

Cisco IOS Release 15.2(1)T adds support for enabling Annex M data structures on Cisco 887VA platforms and Annex A data structures on Cisco 887VA-M platforms. This features allows both Annex A and Annex M structures to be run on the same platform with a performance tradeoff for the annex that is not optimized for the device. With this feature implementation, the modes supported on Annex A platforms are the same as the modes supported on Annex M platforms (887VA-M and EHWIC-1DSL-VA-M). When digital subscriber line access multiplexer (DSLAM) supports Annex M, Annex M mode takes precedence over Annex A mode.

Note Cisco 867VAE and 867VAE-K9 require Cisco IOS Release 15.1(4)M2 or 15.2(2)T or later to use this feature.

For information on configuring Annex M data structures on Annex A platforms, see the, "Enabling ADSL2/2+ Annex M Mode on Over POTS VDSL2/ADSL Multimode Annex A SKUs" section on page 3-30.

Configuring Seamless Rate Adaption

ADSL connections can be dropped due to a number of reasons, such as crosstalk, changes in noise margin, temperature changes, or interference. ADSL2 addresses these problems by adapting the data rate in real-time. Seamless rate adaptation (SRA) enables the ADSL2 system to change the data rate of the connection during operation without any service interruption or bit errors.

Note These features are not currently available on the 866VAE, 867VAE, 866VAE-K9, and 867VAE-K9.

For information on configuring SRA, see the "Enabling Seamless Rate Adaption" section on page 3-31.

Configuring UBR+

UBR is typically used for data communications applications, such as file transfer and email. UBR is a best effort service and is the lowest class of service in the hierarchy. There are no guarantees to the actual bandwidth allowed. Therefore, UBR virtual circuits (VCs) are susceptible to a large number of cell drops or a high cell transfer delay as cells move from the source to the destination. UBR has no bounds on Cell Delay Variation Tolerance (CDVT) and is only a best effort service.

UBR+ is a special ATM service class developed by Cisco. UBR defines only peak cell rate (PCR); however, UBR+ defines a minimum guaranteed cell rate (MCR) and (on the switch) a cell delay variation tolerance (CDVT).

Note On Cisco IOS versions 15.2(1)T and later, UBR+ is compatable with Cisco Multimode 886VA and 887VA routers.

Note These features are not currently available on the 866VAE, 867VAE, 866VAE-K9, and 867VAE-K9.

For information on configuring UBR+, see the "Configuring UBR+" section on page 3-32.

Configuring ADSL Mode

Configuration tasks

Perform the following tasks to configure ADSL mode:

- Configuring ADSL Auto Mode, page 3-17
- Configuring CPE and Peer for ADSL Mode, page 3-18
- Verifying ADSL Configuration, page 3-22
- Verifying CPE to Peer Connection for ADSL, page 3-24

Configuring ADSL Auto Mode

Perform these steps to configure the DSL controller to auto mode, starting in global configuration mode.

Note Configure the DSLAM in ADSL 1/2/2+ mode prior to configuring the router.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller vdsl** *slot*
4. **operating mode {auto | adsl1 | adsl2 | adsl2+ | vdsl2 | {ansi |etsi}}**

   Note The ansi option is available only for models that support POTS. The etsi option is available only for models that support ISDN.

5. **end**

DETAILED STEPS

	Command	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller vdsl** *slot* **Example:** `Router(config)# controller vdsl 0`	Enters config mode for the VDSL controller.

	Command	Purpose
Step 4	**operating mode {auto | adsl1 | adsl2 | adsl2+ | vdsl2 | ansi}** **Example:** `Router(config-controller)# operating mode auto`	Configures the operating mode. The default is auto and is recommended. **Note** When configured in auto, the operating mode does not appear in the **show running** command.

Step 5	**end**
	
	Example:
	`Router(config-controller)# end`
	`Router#`
		Exits the configuration mode and enters EXEC mode.
		
		Note A reload is required after changing mode between adsl and vdsl for Cisco 866VAE, Cisco 867VAE, Cisco 866VAE-K9, and Cisco 867VAE-K9.

Configuring CPE and Peer for ADSL Mode

When configuring for ADSL, the ATM main interface or ATM sub-interface must be configured with a PVC and an IP address, perform a **no shutdown** command on the interface if needed.

SUMMARY STEPS

1. **interface** *type number*
2. **no shutdown**
3. **interface atm0.1 point-to-point**
4. **ip address** *ip-address mask*
5. **pvc [name] vpi/vci**
6. **protocol** *protocol* {*protocol-address* **[virtual-template] | inarp} [[no] broadcast | disable-check-subnet | [no] enable-check-subnet]**
7. **end**

DETAILED STEPS

Configuring the ATM CPE side

Perform the following steps to configure the ATM CPE side, starting in global configuration mode.

	Command	Purpose

Step 1	**interface** *type number*
	
	Example:
	`Router(config)# interface atm0`
	`Router(config-if)#`
		Enters configuration mode for the ATM WAN interface (ATM0).

Step 2	**no shutdown**
	
	Example:
	`Router(config-if)# no shutdown`
	`Router(config-if)#`
		Enables the configuration changes to the ATM interface.

	Command	Purpose

Step 3	**interface atm0.1 point-to-point**
	
	Example:
	`Router(config-if)# interface ATM0.1 point-to-point`
	`Router(config-subif)#`
		Enables ATM0.1 point-to-point interface.

Step 4	**ip address** *ip-address mask* **Example:** `Router(config-subif)# ip address 30.0.0.1 255.255.255.0`	Enters IP address and subnet mask.

Step 5	**pvc [name] vpi/vci**
	
	Example:
	`Router(config-subif)# pvc 13/32`
	`Router(config-if-atm-vc)#`
		Creates or assigns a name to an ATM PVC and enters the ATM virtual circuit configuration mode.

Step 6	**protocol** *protocol* {*protocol-address* **[virtual-template] | inarp} [[no] broadcast | disable-check-subnet | [no] enable-check-subnet]** **Example:** `Router(config-if-atm-vc)# protocol ip 30.0.0.2 broadcast`	Configures a static map for an ATM PVC.

Step 7	**end**
	
	Example:
	`Router(config-if-atm-vc)# end`
	`Router#`
		Exits the configuration mode and enters EXEC mode.

Configuring the ATM Peer side

Perform the following steps to configure the ATM peer side, starting in global configuration mode.

	Command	Purpose
Step 1	**interface** *type number* **Example:** `Router(config)# interface atm0`	Enters configuration mode for the ATM WAN interface (ATM0).
Step 2	**no shutdown** **Example:** `Router(config-if)# no shutdown`	Enables the configuration changes to the ATM interface.
Step 3	**interface atm0.1 point-to-point** **Example:** `Router(config-if)# interface ATM0.1 point-to-point`	Enables the ATM0.1 point-to-point interface.

	Command	Purpose
Step 4	**ip address** *ip-address mask* **Example:** `Router(config-subif)# ip address 30.0.0.2 255.255.255.0`	Enters IP address and subnet mask.
Step 5	**pvc [name] vpi/vci** **Example:** `Router(config-subif)# pvc 13/32`	Creates or assigns a name to an ATM PVC and enters the ATM virtual circuit configuration mode.
Step 6	**protocol** *protocol {protocol-address* **[virtual-template] | inarp} [[no] broadcast | disable-check-subnet | [no] enable-check-subnet]** **Example:** `Router(config-if-atm-vc)# protocol ip 30.0.0.1 broadcast`	Configures a static map for an ATM PVC.

Step 7	**end**
	
	Example:
	`Router(config-if-atm-vc)# end`
	`Router#`
		Exits the configuration mode and enters EXEC mode.

ADSL Configuration Example

The following example shows a typical ADSL2+ configuration set to auto mode. Outputs in **bold** are critical.

```
Router# show running
Building configuration...


Current configuration : 1250 bytes
!
! Last configuration change at 02:07:09 UTC Tue Mar 16 2010
!
version 15.1
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
memory-size iomem 10
ip source-route
!
!
!
!
ip cef
```

```
no ipv6 cef
!
!
!
!
license udi pid CISCO887-V2-K9 sn FHK1313227E
license boot module c880-data level advipservices
!
!
vtp domain cisco
vtp mode transparent
!
!
controller VDSL 0
!
vlan 2-4
!
!
!
!
!
interface Ethernet0
 no ip address
 shutdown
 no fair-queue
!
interface BRI0
 no ip address
 encapsulation hdlc
 shutdown
 isdn termination multidrop
!
interface ATM0
 no ip address
 no atm ilmi-keepalive
!
interface ATM0.1 point-to-point
 ip address 30.0.0.1 255.255.255.0
 pvc 15/32
  protocol ip 30.0.0.2 broadcast
!
!

interface FastEthernet0
!
interface FastEthernet1
!
interface FastEthernet2
!
interface FastEthernet3
!
interface Vlan1
 no ip address
!
ip forward-protocol nd
no ip http server
no ip http secure-server
!
!
!
!
!
!
!
```

```
control-plane
!
!
line con 0
 no modem enable
line aux 0
line vty 0 4
 login
 transport input all
!
exception data-corruption buffer truncate
end
```

Verifying ADSL Configuration

Verify that the configuration is set properly by using the **show controller vdsl 0** command from the privileged EXEC mode. Outputs in **bold** are critical.

```
Router# show controller vdsl 0
Controller VDSL 0 is UP


Daemon Status:           Up


                        XTU-R (DS)              XTU-C (US)
Chip Vendor ID:         'BDCM'                   'BDCM'
Chip Vendor Specific:   0x0000                   0x6110
Chip Vendor Country:    0xB500                   0xB500
Modem Vendor ID:        'CSCO'                   'BDCM'
Modem Vendor Specific:  0x4602                   0x6110
Modem Vendor Country:   0xB500                   0xB500
Serial Number Near:    FHK1313227E 887-V2-K 15.1(20100
Serial Number Far:
Modem Version Near:    15.1(20100426:193435) [changahn
Modem Version Far:     0x6110

Modem Status:            TC Sync (Showtime!)
DSL Config Mode:         AUTO
Trained Mode:            G.992.5 (ADSL2+) Annex A
TC Mode:                 ATM
Selftest Result:         0x00
DELT configuration:      disabled
DELT state:              not running
Trellis:                 ON                       ON
Line Attenuation:         1.0 dB                   1.4 dB
Signal Attenuation:       1.0 dB                   0.0 dB
Noise Margin:             6.8 dB                  13.6 dB
Attainable Rate:        25036 kbits/s            1253 kbits/s
Actual Power:            13.7 dBm                12.3 dBm
Total FECS:             0                        0
Total ES:               0                        0
Total SES:              0                        0
Total LOSS:             0                        0
Total UAS:              0                        0
Total LPRS:             0                        0
Total LOFS:             0                        0
Total LOLS:             0                        0
Bit swap:               163                      7

Full inits:             32
Failed full inits:      0
```

```
Short inits:            0
Failed short inits:     0


Firmware        Source          File Name (version)
--------        ------          -------------------
VDSL            embedded        VDSL_LINUX_DEV_01212008 (1)


Modem FW  Version:      100426_1053-4.02L.03.A2pv6C030f.d22j
Modem PHY Version:      A2pv6C030f.d22j



                 DS Channel1     DS Channel0   US Channel1       US Channel0
Speed (kbps):              0           24184             0              1047
Previous Speed:            0           24176             0              1047
Total Cells:               0       317070460             0          13723742
User Cells:                0               0             0                 0
Reed-Solomon EC:           0               0             0                 0
CRC Errors:                0               0             0                 0
Header Errors:             0               0             0                 0
Interleave (ms):        0.00            0.08          0.00             13.56
Actual INP:             0.00            0.00          0.00              1.80


Training Log :  Stopped
Training Log Filename : flash:vdsllog.bin
```

Verifying CPE to Peer Connection for ADSL

Ping the peer to confirm that CPE to peer configuration is set up correctly.

```
Router# ping 30.0.0.2 rep 20

Type escape sequence to abort.
Sending 20, 100-byte ICMP Echos to 30.0.0.2, timeout is 2 seconds:
!!!!!!!!!!!!!!!!!!!!
Success rate is 100 percent (20/20), round-trip min/avg/max = 20/22/28 ms
Router#
```

Configuring VDSL Mode

Configuration tasks

Perform the following tasks to configure VDSL mode:

- Configuring VDSL Auto Mode, page 3-24
- Configuring CPE and Peer for VDSL Mode, page 3-25
- Verifying VDSL Configuration, page 3-28
- Verifying CPE to Peer Connection for VDSL, page 3-30

Configuring VDSL Auto Mode

Perform the following steps to configure the DSL controller to auto mode, starting in global configuration mode.

Note Configure the DSLAM in VDSL2 mode prior to configuring the router.

SUMMARY STEPS

1. **controller vdsl** *slot*
2. **operating mode {auto | adsl1 | adsl2 | adsl2+ | vdsl2 | {ansi |etsi}}**

   Note The ansi option is available only for models that support POTS. The etsi option is available only for models that support ISDN.

3. **end**

DETAILED STEPS

.

	Command	Purpose
Step 1	**controller vdsl** *slot* **Example:** `Router(config)# controller vdsl 0`	Enters config mode for the VDSL controller.
Step 2	**operating mode {auto | adsl1 | adsl2 | adsl2+ | vdsl2 | ansi}** **Example:** `Router(config-controller)# operating mode auto`	Configures the operating mode. The default is auto and is recommended. **Note** When configured in auto, the operating mode does not appear in the **show running** command.

Step 3	**end**
	
	Example:
	`Router(config-controller)# end`
	`Router#`
		Exits the configuration mode and enters EXEC mode.
		
		Note A reload is required after changing the mode on the Cisco 866VAE, Cisco 867VAE, Cisco 866VAE-K9, and Cisco 867VAE-K9.

Configuring CPE and Peer for VDSL Mode

When configuring VDSL, configure the ethernet 0 interface and perform a **no shutdown** command on the interface if needed. Start in the global configuration mode.

Configuring the VDSL CPE Side

Perform the following steps to configure the VDSL CPE side, starting in the global configuration mode.

SUMMARY STEPS

1. **interface** *type number*
2. **ip address** *ip-address mask*
3. **no shutdown**
4. **end**

DETAILED STEPS

	Command	Purpose
Step 1	**interface** *type number* **Example:** `Router(config)# interface ethernet0`	Enters configuration mode for the Ethernet interface 0.
Step 2	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 90.0.0.1 255.255.255.0`	Enters the IP address and subnet mask.
Step 3	**no shutdown** **Example** `Router(config-if)# no shutdown`	Enables the configuration changes to the ip address and subnet mask.

Step 4	**end**
	
	Example
	`Router(config-if)# end`
	`Router#`
		Exits the configuration mode and enters EXEC mode.

Configuring the VDSL Peer Side

Perform the following steps to configure the VDSL Peer side, starting in the global configuration mode.

	Command	Purpose
Step 1	**interface** *type number* **Example:** `Router(config)# interface ethernet0`	Enters configuration mode for the Ethernet interface 0.
Step 2	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 90.0.0.2 255.255.255.0`	Configures the IP address and subnet mask.
Step 3	**no shutdown** **Example** `Router(config-if)# no shutdown`	Enables the configuration changes to the IP address and subnet mask.

Step 4	**end**
	
	Example
	`Router(config-if)# end`
	`Router#`
		Exits the configuration mode and enters EXEC mode.

VDSL Configuration Example

The following example shows a typical output of a VDSL configuration. Outputs in **bold** are critical.

```
Router# show running
Building configuration...


Current configuration : 1250 bytes
!
! Last configuration change at 02:07:09 UTC Tue Mar 16 2010
!
version 15.1
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
memory-size iomem 10
ip source-route
!
!
!
!
ip cef
no ipv6 cef
!
!
!
!
license udi pid CISCO887-V2-K9 sn FHK1313227E
license boot module c880-data level advipservices
!
!
vtp domain cisco
vtp mode transparent
!
!
controller VDSL 0
!
vlan 2-4
!
!
!
!
!
interface Ethernet0
 ip address 30.0.0.1 255.255.255.0
 no fair-queue
!
interface BRI
 no ip address
 encapsulation hdlc
 shutdown
 isdn termination multidrop
!
```

```
interface ATM0
 no ip address
 shutdown
!
!
interface FastEthernet0
!
interface FastEthernet1
!
interface FastEthernet2
!
interface FastEthernet3
!
interface Vlan1
 no ip address
!
ip forward-protocol nd
no ip http server
no ip http secure-server
!
!
!
!
!
!
!
control-plane
!
!
line con 0
 no modem enable
line aux 0
line vty 0 4
 login
 transport input all
!
exception data-corruption buffer truncate
end
```

Verifying VDSL Configuration

Verify the configuration is set properly by using the **show controller vdsl 0** command from privileged EXEC mode. Outputs in **bold** are critical.

```
Router# show controller vdsl 0
Controller VDSL 0 is UP


Daemon Status:           Up


                        XTU-R (DS)              XTU-C (US)

Chip Vendor ID:         'BDCM'                   'BDCM'
Chip Vendor Specific:   0x0000                   0x0000
Chip Vendor Country:    0xB500                   0xB500
Modem Vendor ID:        'CSCO'                   'BDCM'
Modem Vendor Specific:  0x4602                   0x0000
Modem Vendor Country:   0xB500                   0xB500
Serial Number Near:    FHK1313227E 887-V2-K 15.1(20100
Serial Number Far:
Modem Version Near:    15.1(20100426:193435) [changahn
```

```
Modem Version Far:      0x0000


Modem Status:             TC Sync (Showtime!)
DSL Config Mode:          AUTO
Trained Mode:             G.993.2 (VDSL2) Profile 12a
TC Mode:                  PTM
Selftest Result:          0x00
DELT configuration:       disabled
DELT state:               not running
Trellis:                  ON                      OFF
Line Attenuation:          1.0 dB                  0.0 dB
Signal Attenuation:        1.0 dB                  0.0 dB
Noise Margin:             12.0 dB                  9.5 dB
Attainable Rate:         87908 kbits/s           50891 kbits/s
Actual Power:             13.5 dBm                 8.9 dBm
Per Band Status:         D1      D2      D3      U0      U1      U2      U3
Line Attenuation(dB):    0.9     2.3     N/A     7.2     2.9     7.0     N/A
Signal Attenuation(dB):  0.9     2.3     N/A     N/A     2.3     6.6     N/A
Noise Margin(dB):        14.5    9.3     N/A     N/A     N/A     N/A     N/A
Total FECS:              0                        0
Total ES:                0                        0
Total SES:               0                        0
Total LOSS:              0                        0
Total UAS:               0                        0
Total LPRS:              0                        0
Total LOFS:              0                        0
Total LOLS:              0                        0
Bit swap:                1                        0


Full inits:              33
Failed full inits:       0
Short inits:             0
Failed short inits:      0


Firmware        Source          File Name (version)
--------        ------          -------------------
VDSL            embedded        VDSL_LINUX_DEV_01212008 (1)


Modem FW  Version:       100426_1053-4.02L.03.A2pv6C030f.d22j
Modem PHY Version:       A2pv6C030f.d22j


                  DS Channel1     DS Channel0   US Channel1       US Channel0
Speed (kbps):               0           84999             0             48968
Previous Speed:             0           24184             0              1047
Reed-Solomon EC:            0               0             0                 0
CRC Errors:                 0               0             0                 0
Header Errors:              0               0             0                 0
Interleave (ms):         0.00            6.00          0.00              0.00
Actual INP:              0.00            0.00          0.00              0.00


Training Log :  Stopped
Training Log Filename : flash:vdsllog.bin


Router#
```

Verifying CPE to Peer Connection for VDSL

Ping the peer to confirm that CPE to peer configuration is setup correctly.

```
Router# ping 30.0.0.2 rep 20

Type escape sequence to abort.
Sending 20, 100-byte ICMP Echos to 30.0.0.2, timeout is 2 seconds:
!!!!!!!!!!!!!!!!!!!!
Success rate is 100 percent (20/20), round-trip min/avg/max = 20/22/28 ms
Router#
```

Enabling ADSL2/2+ Annex M Mode on Over POTS VDSL2/ADSL Multimode Annex A SKUs

To enable ADSL2/2+ Annex M mode on Over POTS VDSL2/ADSL Multimode Annex A SKUs, perform the following steps.

Note This feature requires Cisco IOS Release 15.2(1)T or a later.

Note Cisco 867VAE and 867VAE-K9 require Cisco IOS Release 15.1(4)M2 or 15.2(2)T or later to use this feature.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller vdsl** *0*
4. **operating mode {adsl1 | adsl2 [***annex a* **|** *annex m***] | adsl2+ [***annex a* **|** *annex m***]| ansi | auto| vdsl2 }**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	`controller vdsl 0`	Enters configuration mode for the VDSL controller.
Step 4	**operating mode {adsl1 | adsl2 [***annex a* **|** *annex m***] | adsl2+ [***annex a* **|** *annex m***] | ansi | auto| vdsl2}** **Example:** `Router(config-controller)# operating mode adsl2+ annex m`	**asdl1**—Configures operation in ITU G.992.1 Annex A full-rate mode. **adsl2**—Configures operation in ADSL2 operating mode-ITU G.992.3 Annex A, Annex L, and Annex M. If an Annex operating mode is not chosen, Annex A, Annex L, and Annex M are enabled. The final mode is decided by negotiation with the DSL access multiplexer (DSLAM). **adsl2+**—Configures operation in ADSL2+ mode-ITU G.992.5 Annex A and AnnexM. If an Annex A operating mode is not chosen, both Annex and Annex M is enabled. The final mode is decided by negotiation with DSLAM. **ansi**—Configures a router to operate in ANSI full-rate mode-ANSI T1.413. **auto**—Default setting. Configures the router so that the DSLAM automatically picks the DSL operating mode, in the sequence described in the "Usage Guidelines" section. All supported modes are enabled. **vdsl2**—Configures operation in ITU G.993.2 mode. *annex a, m*—(Optional) If the annex option is not specified, both Annex A and Annex M are enabled. The final mode is decided by negotiation with the Digital Synchronous Line Access Multiplexer (DSLAM).

Enabling Seamless Rate Adaption

To enable SRA, perform the following steps.

Note SRA mode is disabled by default.

Note SRA requires Cisco IOS Release 15.2(1)T or a later release.

Note These features are not currently available on the Cisco 866VAE, 867VAE, 866VAE-K9, or 867VAE-K9.

SUMMARY STEPS

SRA can be enabled and disabled with the following steps:

1. **enable**
2. **configure terminal**
3. **controller vdsl** *x/y/z*
4. **sra**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router# enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller vdsl** *x/y/z* **Example:** `Router(config)# controller vdsl 0/0/0`	Enters controller configuration mode. Use the controller vdsl command in global configuration mode. This command does not have a no form. *x*—Defines the network module. *y*—Defines the slot number. *z*—Defines the port number.
Step 4	**sra** **Example:** `router(config-controller)# sra`	Enables SRA mode. Use the no form of the command to disable SRA.

Seamless Rate Adaption Example

The following example enables SRA on a VDSL line:

```
!
!
!
rotuer>enable
router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z
router(config)# controller vdsl 0
router(config-controller)# sra
router(config-controller)# end
router#
!
!
!
```

Configuring UBR+

Perform the following steps to configure UBR+.

Note Cisco IOS Release 15.2(1)T or a later release is required to run UBR+ on Cisco 886VA, 887VA, and 887VA-M routers.

Note These features are not currently available on the Cisco 866VAE, 867VAE, 866VAE-K9, or 867VAE-K9.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ubr+** *output-pcr output-mcr* [**input-pcr**] [**input-mcr**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ubr+** *output-pcr output-mcr* [**input-pcr**] [**input-mcr**] **Example:** `Router(config-if-vc)# ubr+ 10000 3000 9000 1000`	Configures unspecified bit rate (UBR) quality of service (QoS) and specifies the output peak cell rate and output minimum guaranteed cell rate for an ATM permanent virtual circuit (PVC), PVC range, switched virtual circuit (SVC), virtual circuit (VC) class, or VC bundle member. To remove the UBR+ parameters, use the **no** form of this command. *output-pcr*—The output peak cell rate (PCR) in kbps. *output-mcr*—The output minimum guaranteed cell rate in kbps. **input-pcr**—(Optional for SVCs only) The input PCR in kbps. If this value is omitted, the input-pcr equals the output-pcr. **input-mcr**—(Optional for SVCs only) The input minimum guaranteed cell rate in kbps. If this value is omitted, the input-mcr equals the output-mcr.

UBR+ Example

The following example configures UBR+ PVC on a DSL line:

```
interface atm 0/0
 pvc 4/100
  ubr+ 2304 2304
```

The following example specifies the output-pcr argument for an ATM PVC to be 100000 kbps and the output-mcr to be 3000 kbps:

```
pvc 1/32
 ubr+ 100000 3000
```

The following example specifies the output-pcr, output-mcr, input-pcr, and input-mcr arguments for an ATM SVC to be 10000 kbps, 3000 kbps, 9000 kbps, and 1000 kbps, respectively:

```
svc lion nsap 47.0091.81.000000.0040.0B0A.2501.ABC1.3333.3333.05
 ubr+ 10000 3000 9000 1000
```

Troubleshooting

There are no new commands for checking traffic on the Cisco 886VA and 887VA. Some helpful commands include the following **show** commands:

- **show interface Ethernet0**
- **show interface ATM0**
- **show interface summary**
- **show controller vdsl 0**
- **show controller atm0**
- **show controller vdsl 0 datapath**
- **show atm pvc**

The "Cisco 860, Cisco 880, and Cisco 890 Series Integrated Services Routers Software Configuration Guide, Troubleshooting" section may also be helpful.

Configuring the Training Log Using the CLI

When you initiate the training log capture using the **debug vdsl 0 training log** on the Cisco 866VAE, Cisco 867VAE, Cisco 866VAE-K9, and Cisco 867VAE-K9 ISRs, the training log file opens. Any messages that are generated are buffered locally and are written to the training log file at 5k bytes per interval. The messages are not written all at one time, as in previous software versions that supported the training log capture feature.

Note A maximum log capacity of 8MB (approximately 1 hour of capture) exists on the Cisco 866VAE, Cisco 867VAE, Cisco 866VAE-K9, and Cisco 867VAE-K9 ISRs. Because of this capacity limitation, when the entire log collection exceeds 8MB, the log capture is automatically terminated.

Note Cisco 866VAE, Cisco 867VAE, Cisco 866VAE-K9, and Cisco 867VAE-K9 ISRs do not support the continuous training log autostop feature.

Capturing the Training Log

By default the training log is saved to `flash:vdsllog.bin`.

To start the training log capture, use the **debug vdsl 0 training log** command.

```
Router# debug vdsl 0 training log
Router#
```

The following confirmation is displayed:

```
Training log generation started for VDSL 0
```

Halting the Training Log Capture

To stop the training log capture, use the **no debug vdsl 0 training log** command.

```
Router# no debug vdsl 0 training log
Router#
```

The following confirmation is displayed:

```
Training Log file for VDSL written to flash:vdsllog.bin
```

Displaying the Training Log Status and File Location

To display the training log status and file location, use the **show controller vdsl 0** command.

```
Router# show controller vdsl 0
Router#
```

The following confirmation is displayed:

```
Controller VDSL 0 is UP

Daemon Status:           NA

                        XTU-R (DS)              XTU-C (US)
Chip Vendor ID:         'BDCM'                   'BDCM'
Chip Vendor Specific:   0x0000                   0x938C
Chip Vendor Country:    0xB500                   0xB500
Modem Vendor ID:        'CSCO'                   'BDCM'
Modem Vendor Specific:  0x4602                   0x938C
Modem Vendor Country:   0xB500                   0xB500
Serial Number Near:    GMH1049001M 867VAE-K 15.1(20110
Serial Number Far:
Modem Version Near:    15.1(20110422:230431) [suguraja
Modem Version Far:     0x938C

Modem Status:            TC Sync (Showtime!)
DSL Config Mode:         AUTO
Trained Mode:            G.992.5 (ADSL2+) Annex A
TC Mode:                 ATM
Selftest Result:         0x00
```

```
DELT configuration:      disabled
DELT state:              not running
Trellis:                 ON                        ON
Line Attenuation:         0.0 dB                    0.0 dB
Signal Attenuation:       0.0 dB                    0.0 dB
Noise Margin:            16.0 dB                   14.6 dB
Attainable Rate:        28516 kbits/s             1222 kbits/s
Actual Power:             7.0 dBm                  12.4 dBm
Total FECS:             3                         0
Total ES:               0                         0
Total SES:              0                         0
Total LOSS:             0                         0
Total UAS:              147                       147
Total LPRS:             0                         0
Total LOFS:             0                         0
Total LOLS:             0                         0
Bit swap:               0                         0

Full inits:             1
Failed full inits:      0
Short inits:            0
Failed short inits:     0

Firmware        Source          File Name (version)
--------        ------          -------------------
VDSL            embedded         (0)

Modem FW  Version:      23a
Modem PHY Version:      A2pv6C032b.d23a


                  DS Channel1     DS Channel0   US Channel1       US Channel0
Speed (kbps):               0           24543             0              1020
Previous Speed:             0               0             0                 0
Total Cells:                0        87837567             0           3652502
User Cells:                 0               0             0                 0
Reed-Solomon EC:            0               3             0                 0
CRC Errors:                 0               0             0                 0
Header Errors:              0               0             0                 0
Interleave (ms):       0.00            15.00          0.00              3.76
Actual INP:            0.00            57.00          0.00              0.50

Training Log :  Stopped
Training Log Filename : flash:vdsllog.bin
```

Configuring a G.SHDSL WAN Interface in ATM mode

Perform the following steps to configure G.SHDSL on the Cisco 888 ISR perform these steps, beginning in global configuration mode.

SUMMARY STEPS

1. **controller dsl** *slot/port*
2. **mode atm**
3. **line-term cpe**
4. **line-mode 4 wire standard**
5. **line-rate** {**auto** | *rate*}

6. **interface atm** *interface-number*
7. **ip-address** *ip-address*
8. **load-interval** *seconds*
9. **no atm ilmi-keepalive** [*seconds*]
10. **pvc** [*name*] *vpi/vci*
11. **protocol** *protocol protocol-address* **broadcast**
12. **encapsulation** *encapsulation-type*

DETAILED STEPS

	Command	Purpose
Step 1	**controller dsl** *slot/port* **Example:** `Router(config)# controller dsl 0`	Enters controller configuration mode and the controller number.
Step 2	**mode atm** **Example:** `Router(config-ctrl)# mode atm`	Enables ATM encapsulation and creates logical ATM interface 0.
Step 3	**line-term cpe** **Example:** `Router(config-ctrl)# line-term cpe`	Enables CPE.
Step 4	**line-mode 4 wire standard** **Example:** `Router(config-ctrl)# line-mode 4 wire standard`	Enables 4 wire operation.
Step 5	**line-rate** {**auto** | *rate*} **Example:** `Router(config-ctrl)# line-rate 4608`	Specifies the DSL line rate for the SHDSL port. The range is 192 to 2312 kbps. The default is **auto** (negotiated between the SHDSL port and the DSLAM). **Note** If different DSL line rates are configured at opposite ends of the DSL uplink, the actual DSL line rate is always the lower rate. **Note** The maximum peak cell rate is 8 kbps less than the line rate.
Step 6	**interface atm** *interface-number* **Example:** `Router(config-ctrl)# interface atm0`	Enters ATM configuration mode for interface ATM 0.

	Command	Purpose
Step 7	**ip-address** *ip-address* **Example:** `Router(config-ctrl)# ip-address IP-address`	Assigns an IP address to the DSL ATM interface.
Step 8	**load-interval** *seconds* **Example:** `Router(config-ctrl)# load-interval 3`	Assigns a load interval value.
Step 9	**no atm ilmi-keepalive** [*seconds*] **Example:** `Router(config-ctrl)# no atm ilmi-keepalive0`	Disables Integrated Local Management Interface (ILMI) keepalives. If you enable ILMI keepalives without specifying the number of seconds, the default time interval is 3 seconds.
Step 10	**pvc** [*name*] *vpi/vci* **Example:** `Router(config-ctrl)# pvc 0/35`	Enters atm-virtual-circuit (interface-atm-vc) configuration mode, and configures a new ATM PVC by assigning a name (optional) and VPI/VCI numbers. The default traffic shaping is UBR; the default encapsulation is AAL5+LLC/SNAP.
Step 11	**protocol** *protocol protocol-address* **broadcast** **Example:** `Router(config-ctrl)# protocol ip 10.10.10.2 broadcast`	Enables IP connectivity and creates a point-to-point IP address for the VC.
Step 12	**encapsulation** [*encapsulation-type*] **Example:** `Router(config-ctrl)# encapsulation aal5snap`	Configures the ATM adaptation layer (AAL) and encapsulation type. • Use the **aal2** keyword for AAL2 • Use the **aal5ciscoppp** keyword for Cisco PPP over AAL5 • Use the **aal5mux** keyword for AAL5+MUX • Use the **aal5nlpid** keyword for AAL5+NLPID • Use the **aal5snap** keyword for AAL5+LLC/SNAP (the default)

Example

The following configuration example shows a 4-wire standard G.SHDSL configuration.

```
!
controller DSL 0
 mode atm
 line-term cpe
 line-mode 4-wire standard
 dsl-mode shdsl symmetric annex B
 line-rate 4608
!
interface BRI0
 no ip address
```

```
 encapsulation hdlc
 shutdown
 isdn termination multidrop
!
!
interface ATM0
 ip address 10.10.10.1 255.255.255.0
 no atm ilmi-keepalive
 pvc 0/35
  protocol ip 10.10.10.2 broadcast
  encapsulation aal5snap
 !
!
interface FastEthernet0
!
interface FastEthernet1
!
interface FastEthernet2
!
interface FastEthernet3
 shutdown
!
interface Vlan1
 ip address 2.15.15.26 255.255.255.0
!
ip forward-protocol nd
ip route 223.255.254.254 255.255.255.255 Vlan1
no ip http server
no ip http secure-server
!
```

Verifying Configuration

To verify that you have properly configured the router, enter the **show running** command and look for controller DSL and interface ATM0 parameters.

```
Router# show running
Building configuration...

Current configuration : 1298 bytes
!
.......

!
controller DSL 0
 mode atm
 line-term cpe
 line-mode 4-wire standard
 dsl-mode shdsl symmetric annex B
 line-rate 4608
!
!
interface ATM0
 ip address 10.10.10.1 255.255.255.0
 no atm ilmi-keepalive
 pvc 0/31
  protocol ip 10.10.10.5 broadcast
  encapsulation aal5snap
 !
```

Configuring a G.SHDSL WAN Interface in EFM mode

To configure G.SHDSL on the Cisco 888E ISR, perform Configuring Cisco G.SHDSL EFM HWICs in Cisco Routers at:

http://www.cisco.com/en/US/docs/routers/access/interfaces/software/feature/guide/GSHDSL_EFM_HWICS.html

Configuring the Cellular Wireless WAN Interface

The Cisco 880 series ISRs provide a third generation (3G) wireless interface for use over Global System for Mobile Communications (GSM) and code division multiple access (CDMA) networks. The interface is a 34-mm PCMCIA slot.

Its primary application is WAN connectivity as a backup data link for critical data applications. However, the 3G wireless interface can also function as the primary WAN connection for the router.

To configure the 3G cellular wireless interface, follow these guidelines and procedures:

- Prerequisites for Configuring the 3G Wireless Interface, page 3-41
- Restrictions for Configuring the Cellular Wireless Interface, page 3-42
- Data Account Provisioning, page 3-42
- Configuring a Cellular Interface, page 3-46
- Configuring DDR, page 3-48
- Configuring Data Dedicated Transmission Mode (DDTM), page 3-50
- Examples for Configuring Cellular Wireless Interfaces, page 3-50

Prerequisites for Configuring the 3G Wireless Interface

The following are prerequisites to configuring the 3G wireless interface:

- You must have wireless service from a carrier, and you must have network coverage where your router will be physically placed. For a complete list of supported carriers, see the data sheet at:

  http://www.cisco.com/en/US/prod/routers/networking_solutions_products_genericcontent0900aecd80601f7e.html
- You must subscribe to a service plan with a wireless service provider and obtain a SIM card (GSM modem only) from the service provider.
- You must check your LEDs for signal strength, as described in Table 3-2.
- You should be familiar with the Cisco IOS software, beginning with Cisco NX-OS Release 4.1 or later. For Cisco 3G Wireless support, see the Cisco IOS documentation.
- To configure your GSM data profile, you need the following information from your service provider:
  - Username
  - Password
  - Access point name (APN)
- To configure your CDMA data profile for manual activation, you need the following information from your service provider:
  - Master Subsidy Lock (MSL) number
  - Mobile Directory number (MDN)
  - Mobile Station Identifier (MSID)
  - Electronic Serial Number (ESN)

Table 3-2 Front Panel LED Signal Strength Indications

LED	LED Color	Signal Strength
P3G RSSI[1]	Amber	No service available and no RSSI detected
	Solid green	High RSSI (–69 dBm or higher)
	Fast (16 Hz) blinking green	Medium RSSI (–89 to –70 dBm)
	Slow (1 Hz) blinking green	Low to medium RSSI (–99 to –90 dBm), minimum level for a reliable connection
	Off	Low RSSI (less than –100 dBm)

1. 3G RSSI = 3G receive signal strength indication.

Restrictions for Configuring the Cellular Wireless Interface

The following restrictions apply to configuring the Cisco 3G wireless interface:

- A data connection can be originated only by the 3G wireless interface. Remote dial-in is not supported.
- Because of the shared nature of wireless communications, the experienced throughput varies depending on the number of active users or the amount of congestion in a given network.
- Cellular networks have higher latency than wired networks. Latency rates depend on the technology and carrier. Latency may be higher when there is network congestion.
- VoIP is not currently supported.
- Any restrictions that are part of the terms of service from your carrier also apply to the Cisco 3G wireless interface.
- Cisco 880G ISR does not support online insertion and removal (OIR) of 3G modems. To replace a modem with another modem of the same type, use the Cisco CLI to enter the **shutdown** command on the cellular interface before you replace the modems. =
- When a 3G modem is removed, the **show interface cellular 0**, **show run**, and **show version** command outputs still display cellular interface related information. The **show interface** command displays the following message, all other show commands have empty outputs.

  ```
  3G Modem not inserted
  ```

- You can configure the cellular interface when the 3G modem is removed. However, the configuration is not effective until the 3G modem is inserted. The following message is shown when trying to configure the cellular interface while the modem is absent.

  ```
  Router(config)# interface cellular 0
  Warning: 3G Modem is not inserted
  Configuration will not be effective until modem is inserted =
  ```

- Inserting a different type of modem than was previously removed requires configuration changes and you must reload the system.

Data Account Provisioning

Note To provision your modem, you must have an active wireless account with a service provider. A SIM card must be installed in a GSM 3G wireless card.

To provision your data account, follow these procedures:

- Verifying Signal Strength and Service Availability, page 3-43
- Configuring a GSM Modem Data Profile, page 3-44
- CDMA Modem Activation and Provisioning, page 3-45

Verifying Signal Strength and Service Availability

To verify the signal strength and service availability on your modem, use the following commands in privileged EXEC mode.

SUMMARY STEPS

1. **show cellular 0 network**
2. **show cellular 0 hardware**
3. **show cellular 0 connection**
4. **show cellular 0 radio**
5. **show cellular 0 profile**
6. **show cellular 0 security**
7. **show cellular 0 all**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**show cellular 0 network** **Example:** `Router# show cellular 0 network`	Displays information about the carrier network, cell site, and available service.
Step 2	**show cellular 0 hardware** **Example:** `Router# show cellular 0 hardware`	Displays the cellular modem hardware information.
Step 3	**show cellular 0 connection** **Example:** `Router# show cellular 0 connection`	Displays the current active connection state and data statistics.
Step 4	**show cellular 0 radio** **Example:** `Router# show cellular 0 radio`	Shows the radio signal strength. **Note** The RSSI should be better than –90 dBm for steady and reliable connection.
Step 5	**show cellular 0 profile** **Example:** `Router# show cellular 0 profile`	Shows information about the modem data profiles created.

	Command or Action	Purpose
Step 6	**show cellular 0 security** **Example:** `Router# show cellular 0 security`	Shows the security information for the modem, such as SIM and modem lock status.
Step 7	**show cellular 0 all** **Example:** `Router# show cellular 0 all`	Shows consolidated information about the modem. The profiles that were created, the radio signal strength, the network security, and so on.

Configuring a GSM Modem Data Profile

To configure or create a new modem data profile, enter the **cellular 0 gsm profile create** <*profile number*> <*apn*> <*authentication*> <*username*> <*password*> command in privileged EXEC mode. See Table 3-3 for details about the command parameters.

Example

```
Router# cellular 0 gsm profile create 3 apn.com chap GSM GSMPassword
```

Table 3-3 lists the modem data profile parameters.

Table 3-3 Modem Data Profile Parameters

profile number	Number for the profile that you are creating. You can create up to 16 profiles.
apn	Access point name. You must get this information from your service provider.
authentication	Type of authentication, for example, CHAP, PAP.
username	Username provided by your service provider.
password	Password provided by your service provider.

CDMA Modem Activation and Provisioning

Activation procedures may differ, depending upon your carrier. Consult your carrier, and perform one of the following procedures as appropriate:

- Manual activation
- Activation using over the air service provisioning

Table 3-4 lists the activation and provisioning processes supported by different wireless carriers.

Table 3-4 CDMA Modem Activation and Provisioning

Activation and Provisioning Process	Carrier
Manual Activation using MDN, MSID, MSL	Sprint
OTASP[1] Activation	Verizon Wireless
IOTA[2] for Data Profile refresh	Sprint

1. OTASP = Over the Air Service Provisioning.
2. IOTA = Internet Over the Air.

Manual Activation

Note You must have valid mobile directory number (MDN), mobile subsidy lock (MSL), and mobile station identifier (MSID) information from your carrier before you start this procedure.

To configure a modem profile manually, use the following command, beginning in EXEC mode:

cellular 0 cdma activate manual mdn msid sid nid msl

Besides being activated, the modem data profile is provisioned through the Internet Over the Air (IOTA) process. The IOTA process is initiated automatically when you use the **cellular cdma activate manual** command.

The following is a sample output from this command:

```
router# cellular 0 cdma activate manual 1234567890 1234567890 1234 12 12345
NAM 0 will be configured and will become Active
Modem will be activated with following Parameters
MDN :1234567890; MSID :1234567890; SID :1234; NID 12:
Checking Current Activation Status
Modem activation status: Not Activated
Begin Activation
Account activation - Step 1 of 5
Account activation - Step 2 of 5
Account activation - Step 3 of 5
Account activation - Step 4 of 5
Account activation - Step 5 of 5
Secure Commit Result: Succeed
Done Configuring - Resetting the modem
The activation of the account is Complete
Waiting for modem to be ready to start IOTA
Beginning IOTA
router#
*Feb  6 23:29:08.459: IOTA Status Message Received. Event: IOTA Start, Result: SUCCESS
*Feb  6 23:29:08.459: Please wait till IOTA END message is received
*Feb  6 23:29:08.459: It can take up to 5 minutes
*Feb  6 23:29:27.951: OTA State = SPL unlock, Result = Success
*Feb  6 23:29:32.319: OTA State = Parameters committed to NVRAM, Result = Success
```

```
*Feb  6 23:29:40.999: Over the air provisioning complete; Result:Success
*Feb  6 23:29:41.679: IOTA Status Message Received. Event: IOTA End, Result: SUCCESS
```

The IOTA start and end must have "success" as the resulting output. If you receive an error message, you can run IOTA independently by using the **cellular cdma activate iota** command.

Your carrier may require periodic refreshes of the data profile. Use the following command to refresh the data profile:

cellular cdma activate iota

Activating with Over-the-Air Service Provisioning

To provision and activate your modem using Over-the-Air Service Provisioning (OTASP), use the following command, beginning in EXEC mode.

router # **cellular 0 cdma activate otasp** *phone_number*

Note You need to obtain the phone number for use with this command from your carrier. The standard OTASP calling number is *22899.

The following is a sample output from this command:

```
router# cellular 0 cdma activate otasp  *22899
Beginning OTASP activation
OTASP number is *22899
steelers_c881G#
OTA State = SPL unlock, Result = Success
router#
OTA State = PRL downloaded, Result = Success
OTA State = Profile downloaded, Result = Success
OTA State = MDN downloaded, Result = Success
OTA State = Parameters committed to NVRAM, Result = Success
Over the air provisioning complete; Result:Success
```

Configuring a Cellular Interface

To configure the cellular interface, enter the following commands, beginning in privileged EXEC mode.

SUMMARY STEPS

1. **configure terminal**
2. **interface cellular 0**
3. **encapsulation ppp**
4. **ppp chap hostname** *host*
5. **ppp chap password 0** *password*
6. **asynchronous mode interactive**
7. **ip address negotiated**

Note The PPP Challenge Handshake Authentication Protocol (CHAP) authentication parameters that you use in this procedure must be the same as the username and password provided by your carrier and configured only under the GSM profile. CDMA does not require a username or password.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode from the terminal.
Step 2	**interface cellular 0** **Example:** `Router (config)# interface cellular 0`	Specifies the cellular interface.
Step 3	**encapsulation ppp** **Example:** `Router (config-if)# encapsulation ppp`	Specifies PPP encapsulation for an interface configured for dedicated asynchronous mode or dial-on-demand routing (DDR).
Step 4	**ppp chap hostname** *host* **Example:** `Router (config-if)# ppp chap hostname host@wwan.ccs`	Defines an interface-specific Challenge Handshake Authentication Protocol (CHAP) hostname. This must match the username given by the carrier. Applies to GSM only.
Step 5	**ppp chap password 0** *password* **Example:** `Router (config-if)# ppp chap password 0 cisco`	Defines an interface-specific CHAP password. This must match the password given by the carrier.
Step 6	**asynchronous mode interactive** **Example:** `Router (config-if)# asynchronous mode interactive`	Returns a line from dedicated asynchronous network mode to interactive mode, enabling the **slip** and **ppp** commands in privileged EXEC mode.
Step 7	**ip address negotiated** **Example:** `Router (config-if)# ip address negotiated`	Specifies that the IP address for a particular interface is obtained via PPP and IPCP address negotiation.

Note When the cellular interface requires a static IP address, the address may be configured as **ip address negotiated**. Through IP Control Protocol (IPCP), the network ensures that the correct static IP address is allocated to the device. If a tunnel interface is configured with the **ip address unnumbered** *cellular interface* command, the actual static IP address must be configured under the cellular interface, in place of **ip address negotiated**. For a sample cellular interface configuration, see the "Basic Cellular Interface Configuration" section on page 3-50.

Configuring DDR

Perform these steps to configure dial-on-demand routing (DDR) for the cellular interface.

SUMMARY STEPS

1. **configure terminal**
2. **interface cellular 0**
3. **dialer in-band**
4. **dialer idle-timeout** *seconds*
5. **dialer string** *string*
6. **dialer group** *number*
7. **exit**
8. **dialer-list** *dialer-group* **protocol** *protocol-name* {**permit** | **deny** | **list** *access-list-number* | **access-group**}
9. **ip access-list** *access list number* **permit** *ip source address*
10. **line 3**
11. **script dialer** *regexp*
12. **exit**
13. **chat-script** *script name* **"" "ATDT*99#*** *profile number*#" **TIMEOUT** *timeout value* **CONNECT**
    or
    chat-script *script name* "" **"ATDT*777#*** *profile number*#" **TIMEOUT** *timeout value* **CONNECT**
14. **interface cellular 0**
15. **dialer string** *string*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**interface cellular 0** **Example:** `Router (config)# interface cellular 0`	Specifies the cellular interface.
Step 3	**dialer in-band** **Example:** `Router (config-if)# dialer in-band`	Enables DDR and configures the specified serial interface for in-band dialing.

	Command or Action	Purpose
Step 4	**dialer idle-timeout** *seconds* **Example:** `Router (config-if)# dialer idle-timeout 30`	Specifies the duration of idle time, in seconds, after which a line is disconnected.
Step 5	**dialer string** *string* **Example:** `Router (config-if)# dialer string gsm`	Specifies the number or string to dial. Use the name of the chat script here.
Step 6	**dialer-group** *number* **Example:** `Router (config-if)# dialer-group 1`	Specifies the number of the dialer access group to which a specific interface belongs.
Step 7	**exit** **Example:** `Router (config-if)# exit`	Enters the global configuration mode.
Step 8	**dialer-list** *dialer-group* **protocol** *protocol-name* {**permit** | **deny** | **list** *access-list-number* | **access-group**} **Example:** `Router (config)# dialer-list 1 protocol ip list 1`	Creates a dialer list for traffic of interest and permits access to an entire protocol.
Step 9	**ip access-list** *access list number* **permit** *ip source address* **Example:** `Router (config)# ip access list 1 permit any`	Defines traffic of interest.
Step 10	**line 3** **Example:** `Router (config-line)# line 3`	Specifies the line configuration mode. It is always 3.
Step 11	**script dialer** *regexp* **Example:** `Router (config-line)# script-dialer gsm`	Specifies a default modem chat script.
Step 12	**exit** **Example:** `Router (config-line)# exit`	Exits line configuration mode.

	Command or Action	Purpose
Step 13	For GSM: **chat-script** *script name* **”” “ATDT*99*** *profile number*#” **TIMEOUT** *timeout value* **CONNECT** For CDMA: **chat-script** *script name* "" **"ATDT*777*** *profile number*#" **TIMEOUT** *timeout value* **CONNECT** **Example:** `Router (config)# chat-script gsm "" "ATDT*98*2#" TIMEOUT 60 "CONNECT"`	Configures the line for GSM. Configures the line for CDMA. Defines the Attention Dial Tone (ATDT) commands when the dialer is initiated.
Step 14	**interface cellular 0** **Example:** `Router (config)# interface cellular 0`	Specifies the cellular interface.
Step 15	**dialer string** *string* **Example:** `Router (config)# dialer string gsm`	Specifies the dialer script (defined using the **chat script** command).

Configuring Data Dedicated Transmission Mode (DDTM)

On CDMA modems, data transmission is disrupted by incoming voice calls if data dedicated transmission mode (DDTM) is disabled. You can enable DDTM mode so the modem ignores incoming voice calls.

To enable DDTM on a CDMA modem, use the **cdma ddtm** command in configuration mode.

This command is enabled by default. You can disable this feature by using the **no cdma ddtm** command.

Note When DDTM is enabled, only voice calls are blocked for the MC5728v modems. On the AC597E and MC5725 and MC 5727, incoming SMS messages are also blocked.

Examples for Configuring Cellular Wireless Interfaces

This section provides the following configuration examples:

- Basic Cellular Interface Configuration, page 3-50
- Tunnel over Cellular Interface Configuration, page 3-51

Basic Cellular Interface Configuration

The following example shows how to configure a gsm cellular interface to be used as a primary WAN connection. It is configured as the default route.

```
chat-script gsm "" "ATDT*98*2#" TIMEOUT 60 "CONNECT"

!
interface Cellular0
```

```
 ip address negotiated
 encapsulation ppp
 dialer in-band
 dialer string gsm
 dialer-group 1
 async mode interactive
 ppp chap hostname cisco@wwan.ccs
 ppp chap password 0 cisco
 ppp ipcp dns request
!

ip route 0.0.0.0 0.0.0.0 Cellular0
!
!
access-list 1 permit any
dialer-list 1 protocol ip list 1
!
line 3
 exec-timeout 0 0
 script dialer gsm
 login
 modem InOut
```

The following example shows how to configure a cdma cellular interface to be used as a primary. It is configured as the default route.

```
chat-script cdma "" "ATDT#777" TIMEOUT 60 "CONNECT"

!
interface Cellular0
 ip address negotiated
 encapsulation ppp
 dialer in-band
 dialer string cdma
 dialer-group 1
 async mode interactive
 ppp chap password 0 cisco
!

ip route 0.0.0.0 0.0.0.0 Cellular0
!
!
access-list 1 permit any
dialer-list 1 protocol ip list 1
!
line 3
 exec-timeout 0 0
 script dialer cdma
 login
 modem InOut
```

Tunnel over Cellular Interface Configuration

The following example shows how to configure the static IP address when a tunnel interface is configured with the **ip address unnumbered** <*cellular interface*> command:

```
interface Tunnel2
 ip unnumbered Cellular0
 tunnel source Cellular0
 tunnel destination 128.107.248.254

interface Cellular0
```

```
 bandwidth receive 1400000
 ip address 23.23.0.1 255.255.0.0
 ip nat outside
 ip virtual-reassembly
 encapsulation ppp
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout 0
 dialer string dial<carrier>
 dialer-group 1
 async mode interactive
 no ppp lcp fast-start
 ppp chap hostname <hostname>        *** gsm only ***
 ppp chap password 0 <password>
 ppp ipcp dns request
 ! traffic of interest through the tunnel/cellular interface
ip route 10.10.0.0 255.255.0.0 Tunnel2
```

Configuring WAN Mode on Cisco 860VAE ISRs

The Cisco 866VAE, Cisco 867VAE, Cisco 866VAE-K9, and Cisco 867VAE-K9 routers can be configured to use either a GE interface or a DSL interface as a WAN link. DSL is the default WAN interface when the Cisco 866VAE, Cisco 867VAE, Cisco 866VAE-K9, and Cisco 867VAE-K9 routers boot.

After the router boots up, the desired WAN interface can be selected using the **wan mode** command. When WAN mode is configured as Ethernet, both ATM0 and Ethernet0 interfaces will be forced into shutdown state. Entering the **no shutdown** command on either of the DSL interfaces will be rejected with a message ***WAN interface is Ethernet***. Similarly, when the WAN mode is DSL, the GE WAN interface will be put in shutdown state and the **no shutdown** command will be rejected with the message ***WAN interface is DSL***.

Note The routers do not support enabling both GE and DSL interfaces simultaneously.

Use the **wan mode dsl | ethernet** command to switch from DSL to Ethernet interfaces or vice versa.

This section contains the following information:

- Enabling WAN Mode, page 3-52
- Displaying WAN Mode Configuration, page 3-53

Enabling WAN Mode

Perform the following steps to select and enable WAN mode.

SUMMARY STEPS

1. **enable**
2. **show running-configuration**
3. **wan mode {dsl | ethernet}**
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show running-configuration** **Example:** `Router# show running-configuration`	Displays the default entries on boot up.
Step 3	**wan mode {dsl | ethernet}** **Example:** `Router(config)# wan mode dsl`	Selects the desired WAN mode.

Step 4	**exit**
	
	Example:
	`Router(config)# exit`
	`Router#`
		Exits configuration mode and returns to it would take the router back to privileged EXEC mode.

Displaying WAN Mode Configuration

Use the **show running-config** command to view the initial configuration, as shown in the following example for a Cisco 866VAE router.

Note Your Cisco router displays the WAN mode during the boot sequence after the initial configuration is complete.

```
Router#show running-config
Building configuration...

Current configuration : 1195 bytes
!
! Last configuration change at 13:27:25 UTC Wed Feb 24 2010
version 15.2
no service pad
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
no service password-encryption
!
hostname Router
!
boot-start-marker
boot-end-marker
!
!
enable password lab
!
no aaa new-model
wan mode ethernet
```

```
no ipv6 cef
!
!
!
!
!
ip cef
!
crypto pki token default removal timeout 0
!
!
!
!
!
!
controller VDSL 0
 shutdown
!
!
!
!
!
interface ATM0
 no ip address
 shutdown
 no atm ilmi-keepalive
!
interface ATM0.1 point-to-point
 ip address 202.0.0.1 255.255.255.0
 pvc 0/202
 !
!
interface Ethernet0
 no ip address
 shutdown
!
interface FastEthernet0
 no ip address
!
interface FastEthernet1
 no ip address
!
interface FastEthernet2
 no ip address
!
interface FastEthernet3
 no ip address
!
interface GigabitEthernet0
 ip address 1.0.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface Vlan1
 no ip address
!
ip forward-protocol nd
no ip http server
no ip http secure-server
!
!
!
!
control-plane
```

```
!
!
line con 0
 exec-timeout 0 0
 no modem enable
line aux 0
line vty 0 4
 login
 transport input all
!
scheduler allocate 60000 1000
!
end

Router#
```

Configuring the Fast Ethernet LAN Interfaces

The Fast Ethernet LAN interfaces on your router are automatically configured as part of the default VLAN and are not configured with individual addresses. Access is provided through the VLAN. You can also assign the interfaces to other VLANs. For more information about creating VLANs, see Chapter 7, "Configuring Ethernet Switches."

Configuring the Wireless LAN Interface

The Cisco 860, Cisco 880, and Cisco 890 series wireless routers have an integrated 802.11n module for wireless LAN connectivity. The router can then act as an access point in the local infrastructure. For more information about configuring a wireless connection, see Chapter 9, "Basic Wireless Device Configuration."

Configuring a Loopback Interface

The loopback interface acts as a placeholder for the static IP address and provides default routing information.

Perform these steps to configure a loopback interface, beginning in global configuration mode:

SUMMARY STEPS

1. **interface** *type number*
2. **ip address** *ip-address mask*
3. **exit**

DETAILED STEPS

	Command	Purpose

Step 1	**interface** *loopback number*
	
	Example:
	`Router(config)# interface Loopback 0`
	`Router(config-if)#`
		Enters configuration mode for the loopback interface.
		
		number—number of the loopback interface.

Step 2	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 10.108.1.1 255.255.255.0`	Sets the IP address and subnet mask for the loopback interface.

Step 3	**exit**
	
	Example:
	`Router(config-if)# exit`
	`Router(config)#`
		Exits configuration mode for the loopback interface and returns to global configuration mode.

Example

The loopback interface in this sample configuration is used to support Network Address Translation (NAT) on the virtual-template interface. This configuration example shows the loopback interface configured on the Fast Ethernet interface with an IP address of 200.200.100.1/24, which acts as a static IP address. The loopback interface points back to virtual-template1, which has a negotiated IP address.

```
!
interface loopback 0
ip address 200.200.100.1 255.255.255.0 (static IP address)
ip nat outside
!
interface Virtual-Template1
ip unnumbered loopback0
no ip directed-broadcast
ip nat outside
!
```

Verifying Configuration

To verify that you have properly configured the loopback interface, enter the **show interface loopback** command. You should see verification output similar to the following example.

```
Router# show interface loopback 0
Loopback 0 is up, line protocol is up
  Hardware is Loopback
  Internet address is 200.200.100.1/24
  MTU 1514 bytes, BW 8000000 Kbit, DLY 5000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation LOOPBACK, loopback not set
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/0, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
```

```
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Another way to verify the loopback interface is to ping it:

```
Router# ping 200.200.100.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.100.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

Configuring Static Routes

Static routes provide fixed routing paths through the network. They are manually configured on the router. If the network topology changes, the static route must be updated with a new route. Static routes are private routes unless they are redistributed by a routing protocol.

Follow these steps to configure static routes, beginning in global configuration mode.

SUMMARY STEPS

1. **ip route** *prefix mask* {*ip-address* | *interface-type interface-number* [*ip-address*]}
2. **end**

DETAILED STEPS

	Command	Purpose
Step 1	**ip route** *prefix mask* {*ip-address* | *interface-type interface-number* [*ip-address*]} **Example:** `Router(config)# ip route 192.168.1.0 255.255.0.0 10.10.10.2`	Specifies the static route for the IP packets. For details about this command and about additional parameters that can be set, see the *Cisco IOS IP Routing Protocols Command Reference*.

Step 2	**end**
	
	Example:
	`Router(config)# end`
	`Router#`
		Exits router configuration mode, and enters privileged EXEC mode.

For general information on static routing, see the "Concepts" section on page B-1

Example

In the following configuration example, the static route sends out all IP packets with a destination IP address of 192.168.1.0 and a subnet mask of 255.255.255.0 on the Fast Ethernet interface to another device with an IP address of 10.10.10.2. Specifically, the packets are sent to the configured PVC.

You do not need to enter the command marked "(**default**)." This command appears automatically in the configuration file generated when you use the **show running-config** command.

```
!
ip classless (default)
ip route 192.168.1.0 255.255.255.0 10.10.10.2!
```

Verifying Configuration

To verify that you have properly configured static routing, enter the **show ip route** command and look for static routes signified by the "S."

You should see verification output similar to the following:

```
Router# show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 1 subnets
C       10.108.1.0 is directly connected, Loopback0
S* 0.0.0.0/0 is directly connected, FastEthernet0
```

Configuring Dynamic Routes

In dynamic routing, the network protocol adjusts the path automatically, based on network traffic or topology. Changes in dynamic routes are shared with other routers in the network.

The Cisco routers can use IP routing protocols, such as Routing Information Protocol (RIP) or Enhanced Interior Gateway Routing Protocol (EIGRP), to learn routes dynamically. You can configure either of these routing protocols on your router.

- Configuring Routing Information Protocol, page 3-59
- Configuring Enhanced Interior Gateway Routing Protocol, page 3-60

Configuring Routing Information Protocol

To configure the RIP routing protocol on the router, perform these steps, beginning in global configuration mode:

SUMMARY STEPS

1. **router rip**
2. **version** {**1** | **2**}
3. **network** *ip-address*
4. **no auto-summary**
5. **end**

DETAILED STEPS

	Command	Task

Step 1	**router rip**
	
	Example:
	`Router(config)# router rip`
	`Router(config-router)#`
		Enters router configuration mode, and enables RIP on the router.

Step 2	**version** {**1**	**2**} **Example:** `Router(config-router)# version 2`	Specifies use of RIP version 1 or 2.

Step 3	**network** *ip-address*
	
	Example:
	`Router(config-router)# network 192.168.1.1`
	`Router(config-router)# network 10.10.7.1`
		Specifies a list of networks on which RIP is to be applied, using the address of the network of each directly connected network.

Step 4	**no auto-summary** **Example:** `Router(config-router)# no auto-summary`	Disables automatic summarization of subnet routes into network-level routes. This allows subprefix routing information to pass across classfull network boundaries.

Step 5	**end**
	
	Example:
	`Router(config-router)# end`
	`Router#`
		Exits router configuration mode, and enters privileged EXEC mode.

For general information on RIP, see the "RIP" section on page B-3

Example

The following configuration example shows RIP version 2 enabled in IP network 10.0.0.0 and 192.168.1.0.

To see this configuration, use the **show running-config** command from privileged EXEC mode.

```
!
Router# show running-config
router rip
 version 2
 network 10.0.0.0
 network 192.168.1.0
 no auto-summary
!
```

Verifying Configuration

To verify that you have properly configured RIP, enter the **show ip route** command and look for RIP routes signified by "R." You should see a verification output like the following example.

```
Router# show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 1 subnets
C       10.108.1.0 is directly connected, Loopback0
R    3.0.0.0/8 [120/1] via 2.2.2.1, 00:00:02, Ethernet0/0
```

Configuring Enhanced Interior Gateway Routing Protocol

To configure Enhanced Interior Gateway Routing Protocol (EIGRP), perform these steps, beginning in global configuration mode:

SUMMARY STEPS

1. **router eigrp** *as-number*
2. **network** *ip-address*
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	**router eigrp** *as-number* **Example:** `Router(config)# router eigrp 109`	Enters router configuration mode and enables EIGRP on the router. The autonomous-system number identifies the route to other EIGRP routers and is used to tag the EIGRP information.

	Command	Purpose

Step 2	**network** *ip-address*
	
	Example:
	`Router(config)# network 192.145.1.0`
	`Router(config)# network 10.10.12.115`
		Specifies a list of networks on which EIGRP is to be applied, using the IP address of the network of directly connected networks.

Step 3	**end**
	
	Example:
	`Router(config-router)# end`
	`Router#`
		Exits router configuration mode and enters privileged EXEC mode.

For general information on EIGRP concepts, see the "Enhanced IGRP" section on page B-3

Example

The following configuration example shows the EIGRP routing protocol enabled in IP networks 192.145.1.0 and 10.10.12.115. The EIGRP autonomous system number is 109.

To see this configuration, use the **show running-config** command, beginning in privileged EXEC mode.

```
!
router eigrp 109
    network 192.145.1.0
        network 10.10.12.115
!
```

Verifying Configuration

To verify that you have properly configured IP EIGRP, enter the **show ip route** command and look for EIGRP routes indicated by "D." You should see verification output similar to the following:

```
Router# show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 1 subnets
C       10.108.1.0 is directly connected, Loopback0
D    3.0.0.0/8 [90/409600] via 2.2.2.1, 00:00:02, Ethernet0/0
```